

Lean Concepts & Six Sigma

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Introduction

Lean is a systematic approach focused on **eliminating waste**, improving efficiency, and maximizing customer value. Originally derived from the **Toyota Production System (TPS)**, Lean principles are widely used in manufacturing, supply chain management, healthcare, and software development.

Core Principles of Lean

Lean is built on **five core principles** defined by the **Lean Enterprise Institute (LEI)**:

1. Identify Value

- Value is defined from the **customer's perspective**—what they are willing to pay for.
- Anything that does not add value to the customer is considered waste.
- **Example:** A smartphone manufacturer focusing on **faster charging and better battery life** instead of unnecessary features.

2. Map the Value Stream

- A **Value Stream** includes all steps involved in delivering a product or service.
- This helps in identifying **waste (non-value-added activities)** and improving process efficiency.
- **Example:** In an **automobile assembly line**, mapping the value stream helps identify delays in material handling.

3. Create Flow

- After eliminating waste, ensure that work flows smoothly without interruptions.
- **Bottlenecks** in production or service delivery should be minimized.
- **Example:** In a hospital, organizing patient records digitally can reduce waiting times and improve patient care.

4. Establish Pull

- Instead of **producing in bulk**, Lean promotes **pull-based** production, meaning items are made **only when needed**.
- This reduces overproduction and inventory costs.
- **Example:** An **e-commerce warehouse** stocking **only the most demanded products** instead of keeping excessive inventory.

5. Seek Perfection (Continuous Improvement)

- Lean is an ongoing process of **continuous improvement (Kaizen)**.
- Teams should continuously refine their processes to achieve operational excellence.
- **Example:** A **software development team** using Agile practices to regularly update their products based on customer feedback.

Types of Waste in Lean (Muda, Mura, Muri)

Lean focuses on eliminating waste, which can be categorized into **three types**:

1. Muda (Non-Value-Added Waste)

- Activities that do not add value to the product or service.
- **Types of Muda (TIMWOODS):**
 - **T**ransportation – Unnecessary movement of materials.
 - **I**nventory – Excess stock that leads to higher storage costs.
 - **M**otion – Unnecessary movement of workers.
 - **W**aiting – Delays in processes.
 - **O**verproduction – Producing more than what is needed.
 - **O**verprocessing – Doing more work than required.
 - **D**efects – Faulty products leading to rework.
 - **S**kills – Underutilization of employee skills.
- **Example:** In a factory, excessive movement of workers between stations (Motion waste) or storing unnecessary raw materials (Inventory waste).

2. Mura (Inconsistency/Variability)

- Uneven workflows cause inefficiencies and bottlenecks.
- **Example:** A restaurant having unpredictable demand fluctuations, leading to food waste or service delays.

3. Muri (Overburdening of People or Machines)

- Pushing workers or machines beyond their capacity leads to fatigue and breakdowns.
- **Example:** A factory forcing workers to work extra shifts without breaks, leading to lower productivity and higher errors.

Key Lean Tools & Techniques

1. Kaizen (Continuous Improvement)

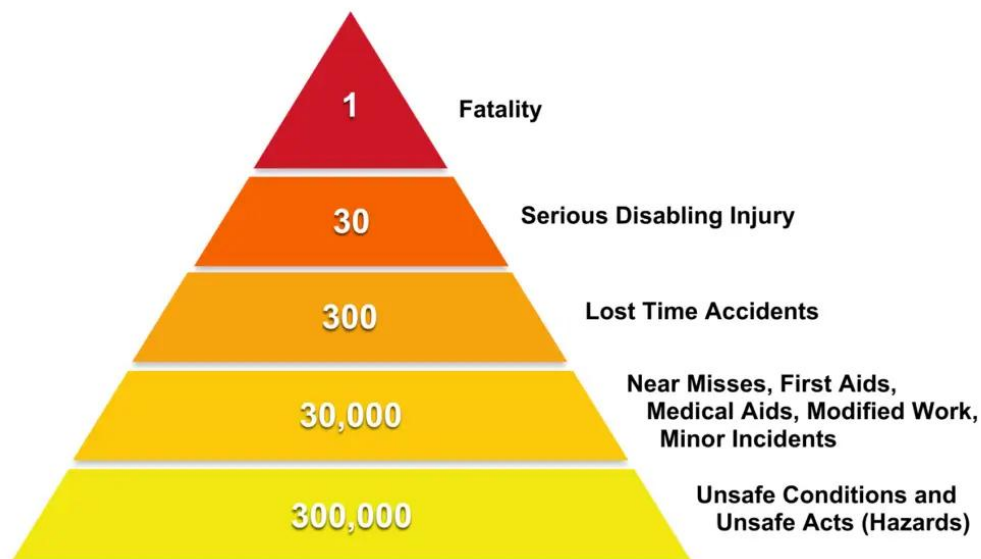
- Small, incremental changes that improve efficiency over time.
- Encourages **employee involvement** in problem-solving.
- **Example:** A team holding daily stand-up meetings to discuss process improvements.

2. 5S +1S Methodology (Workplace Organization)

- **Sort (Seiri)** – Remove unnecessary items.
- **Set in Order (Seiton)** – Organize tools and materials for easy access.
- **Shine (Seiso)** – Clean the workspace to maintain efficiency.
- **Standardize (Seiketsu)** – Create standards for processes.
- **Sustain (Shitsuke)** – Continuously improve and maintain the system.
- **Example:** Organizing an office workspace to improve efficiency and reduce time wasted searching for files.
- **Safety**

SAFETY PYRAMID

It is far better to be reporting and learning from Near Misses, Minor Incidents and Hazards, where there is little or no loss, than to be reporting actual serious losses.



Heinrich Safety Pyramid

3. Kanban (Visual Workflow Management)

- A **pull-based system** that signals when work needs to be done.
- Helps in **tracking work progress** and avoiding overproduction.
- **Example:** A software development team using a **Kanban board** to track tasks as "To Do," "In Progress," and "Done."

4. Just-in-Time (JIT) Production

- Producing **only what is needed, when needed, and in the amount needed**.
- Reduces inventory costs and increases efficiency.
- **Example:** An **automobile manufacturer** receiving engine parts **only when needed** instead of keeping excess stock.

5. Value Stream Mapping (VSM)

- A **visual tool** to analyze and improve processes by identifying waste.
- **Example:** A hospital using VSM to reduce **patient waiting time** by eliminating unnecessary administrative steps.

6. Poka-Yoke (Error Proofing)

- Designing processes that **prevent mistakes** before they happen.
- **Example:** ATMs returning a card **before dispensing cash** to prevent users from forgetting their card.

Benefits of Lean Implementation

Benefit	Impact
Reduced Waste	Eliminates unnecessary costs and inefficiencies.
Improved Quality	Fewer defects and better customer satisfaction.
Faster Delivery	Streamlined processes ensure quicker production and service.
Lower Costs	Optimized inventory and reduced waste lower expenses.
Higher Employee Engagement	Employees contribute ideas and improvements.

Customer Satisfaction	Faster, high-quality, and cost-effective products.
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Lean vs. Six Sigma

Feature	Lean	Six Sigma
Focus	Waste elimination	Reducing variation & defects
Main Tool	Value Stream Mapping, 5S, Kanban	DMAIC (Define, Measure, Analyze, Improve, Control)
Application	Process efficiency	Process quality improvement
Industry Usage	Manufacturing, services, healthcare	Manufacturing, finance, healthcare

Conclusion

Lean is a powerful methodology that **reduces waste, improves efficiency, and enhances customer value**. By applying tools like **Kaizen, 5S, Kanban, and JIT**, businesses can achieve continuous improvement and **optimize their operations**. When combined with **Six Sigma**, Lean becomes even more effective in achieving high-quality, cost-efficient processes.